

REPRODUCTION OF THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1-46. (Canceled)

47. (Previously Presented) A bone fixation apparatus comprising:
a bone fixation plate having a fixation hole;
a fastener shaft passing through the fixation hole, the fastener shaft having a longitudinal axis, the fastener shaft including a first portion having an outer surface defining a first cam, the fastener shaft including a second bone-engaging portion; and
an annular member received in the fixation hole, the annular member circumferentially surrounding the first portion of the fastener shaft having an inner surface defining a second cam for cooperating with the first cam to selectively expand the annular member in a radial direction from an unexpanded position to an expanded position, wherein in the unexpanded position the fastener shaft and the annular member can rotate freely about the axis of the fastener shaft and collectively seat in the fixation hole at various angles relative to the fixation plate, and wherein in the expanded position the fastener shaft and annular member are prevented from backing out of the fixation hole.

48. (Previously Presented) The bone fixation apparatus of claim 47, wherein the first and second cams are configured to provide a semi-constrained mode of operation in which the fastener shaft is retained relative to the plate and the annular member is free to move within the fixation hole and a constrained mode of operation in which the fastener shaft is retained relative to the plate and the annular member is fixed in the fixation hole.

49. (Previously Presented) The bone fixation apparatus of claim 47, wherein the annular member has a curved outer surface mating with an inner surface of the fixation hole.

50. (Previously Presented) The bone fixation apparatus of claim 49, wherein the outer surface of the annular member and the inner surface of the fixation hole are spherical.

51. (Previously Presented) The bone fixation apparatus of claim 47, wherein the annular member has an expanded diameter sufficiently large to press against the fixation hole and arrest relative movement between the fixation hole and the fastener shaft in the expanded position.

52. (Previously Presented) The bone fixation apparatus of claim 47, wherein the annular member has an expanded diameter sufficiently small to allow the annular member to freely rotate relative to the fixation hole in the expanded position.

53. (Previously Presented) The bone fixation apparatus of claim 47, wherein each of the first and second cams include three continuously curved lobes.

54. (Previously Presented) The bone fixation apparatus of Claim 47, wherein the fixation plate is a spinal fixation plate for securing first and second vertebral bodies relative to one another.

55. (Previously Presented) The bone fixation apparatus of Claim 47, wherein the fastener shaft defines a circumferentially extending groove having a reduced diameter and the annular member is carried by the fastener shaft in the circumferentially extending groove.

56. (Previously Presented) The bone fixation apparatus of Claim 47, wherein the annular member is coupled to the fastener shaft for relative articulation therewith.

57. (Previously Presented) The bone fixation apparatus of Claim 47, wherein the annular member is selectively moved between the expanded and unexpanded positions by rotation of the fastener shaft relative to the annular member and independent from longitudinal translation of the fastener shaft relative to the annular member.

58. (Previously Presented) A bone fixation apparatus comprising:

a bone fixation plate having a fixation hole, the fixation hole having a continuously curved inner spherical surface extending proximate an upper surface of the bone fixation plate to proximate a lower surface of the bone fixation plate;

a fastener shaft having a longitudinal axis, a bone-anchoring portion and an upper portion, the upper portion defining a curved outer cam; and

an expandable annular member having an outer spherical surface and an inner surface defining an inner cam, the inner cam circumferentially mating and aligned with the outer cam in an unexpanded configuration of the annular member, the inner cam circumferentially misaligned relative to the outer shaft cam in an expanded configuration of the annular member, such that in the unexpanded configuration the fastener shaft and the annular member can rotate freely about the longitudinal axis of the fastener shaft and seat in the fixation hole at various angles relative to the fixation plate, and in the expanded configuration the fastener shaft and annular member are prevented from backing out of the fixation hole.

59. (Previously Presented) The bone fixation apparatus of claim 58, wherein the inner cam and the outer cam are configured to provide a semi-constrained mode of operation in which the fastener shaft is retained relative to the plate and the annular member is free to move within the fixation hole and a constrained mode of operation in which the fastener shaft is retained relative to the plate and the annular member is fixed in the fixation hole.

60. (Previously Presented) The bone fixation apparatus of claim 58, wherein the annular member has an expanded diameter sufficiently large to press against the fixation hole and arrest relative movement between the fixation hole and the fastener shaft in the expanded position.

61. (Previously Presented) The bone fixation apparatus of claim 58, wherein the annular member has an expanded diameter sufficiently small to allow the annular member to freely rotate relative to the fixation hole in the expanded position.

62. (Previously Presented) The bone fixation apparatus of claim 58, wherein the fixation plate is a spinal fixation plate for securing first and second vertebral bodies relative to one another.

63. (Previously Presented) The bone fixation apparatus of claim 58, wherein the fastener shaft defines a circumferentially extending groove having a reduced diameter and the annular member is carried by the fastener shaft in the groove such that the annular member is coupled to the fastener shaft for relative articulation therewith.

64. (Previously Presented) The bone fixation apparatus of claim 57, wherein the annular member is selectively moved between the expanded and unexpanded configurations by rotation of the fastener shaft relative to the annular

member and independent from longitudinal translation of the fastener shaft relative to the annular member.

65. (Previously Presented) A bone fixation apparatus comprising:
a bone fixation plate having a fixation hole;
a fastener shaft having a longitudinal axis and a groove having at least one cam surface; and

an annular member carried in the groove of the fastener shaft for relative articulation with the fastener shaft, the annular member defining an outer surface received within the fixation hole to allow orientation of the fastener shaft at various angles relative to the bone fixation plate, the annular member having an inner surface cooperating with the at least one cam surface of the fastener shaft to radially expand the annular member from an unexpanded position to an expanded position for preventing the fastener shaft from backing out of the fixation hole.

66. (Previously Presented) The bone fixation apparatus of claim 65, wherein the inner surface of the annular member and the outer surface of the fastener shaft are cooperatively configured to provide a semi-constrained mode of operation in which the fastener shaft is retained relative to the plate and the annular member is free to move within the fixation hole and a constrained mode of operation in which the fastener shaft is retained relative to the plate and the annular member is fixed in the fixation hole.